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The avifauna of coastal forests in southeast Tanzania

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The avifauna of the coastal forest patches between the Rufiji and Ruvuma Rivers, southeast Tanzania, have so far received little ornithological attention compared to, for instance, the montane forests of the Eastern Arc Mountains. This is surprising given the large number of studies of other animals and plants that have documented high species richness and, especially for trees, very high numbers of species with restricted distributions (Clarke *et al.* 2000).

This paper summarises information on the distribution of forest birds in the 11 coastal forests in Tanzania south of the Rufiji River for which we have been able to trace data and from our own fieldwork in six forests in 2001. We also include information on old records of forest birds collected near Mikindani although the exact location is unknown. We briefly discuss the species richness of the forests, make a comparison with some other Tanzanian lowland forests and provide new information on distribution and habitat selection of some of the forest birds encountered during our fieldwork. Finally, we explore the hypothesis that the Lindi Plateau forests in the southern part of the study area were a refugium for lowland forest birds during Pleistocene glaciations and that the isolation led to differentiation and the formation of a local centre of endemism.

Study area

A vegetation mosaic of lowland forest, *Brachystegia* forest (*sensu* Clarke 2000a), thicket and fire-climax miombo woodland, together with varying intensities of cultivation and 'farm-bush' occurs along the coast of Tanzania between the Rufiji and Ruvuma Rivers (Clarke 2001). Although a few forest patches (e.g. Kitope and Ndimba Hills) occur on isolated hills close to the sea, most coastal forests are found on or around a row of upland massifs in the coastal hinterland (Clarke 1995, Burgess *et al.* 2000; see Figure 1). The forests are believed to be geographically-isolated remnants of a more widespread evergreen or semi-evergreen closed-canopy forest that has been largely cleared from the heavily-populated coastal region to provide wood and farmland (Clarke & Karoma 2000). This Eastern African coastal forests complex has a geographical range from southern Somalia, through coastal Kenya and Tanzania, to southern Mozambique (Clarke 2000a).

A large number of coastal forests of very different sizes have been reported between the Rufiji and Ruvuma Rivers (e.g. Clarke 1995). Fottland (1996) listed some 37 Forest Reserves for this area though several of these have now been logged. Other Forest Reserves contain different types of woodland rather than forest.

Investigations of the forest avifauna of southeast Tanzania were initiated during the colonial era. More recently, Stjernstedt (1970) visited Rondo

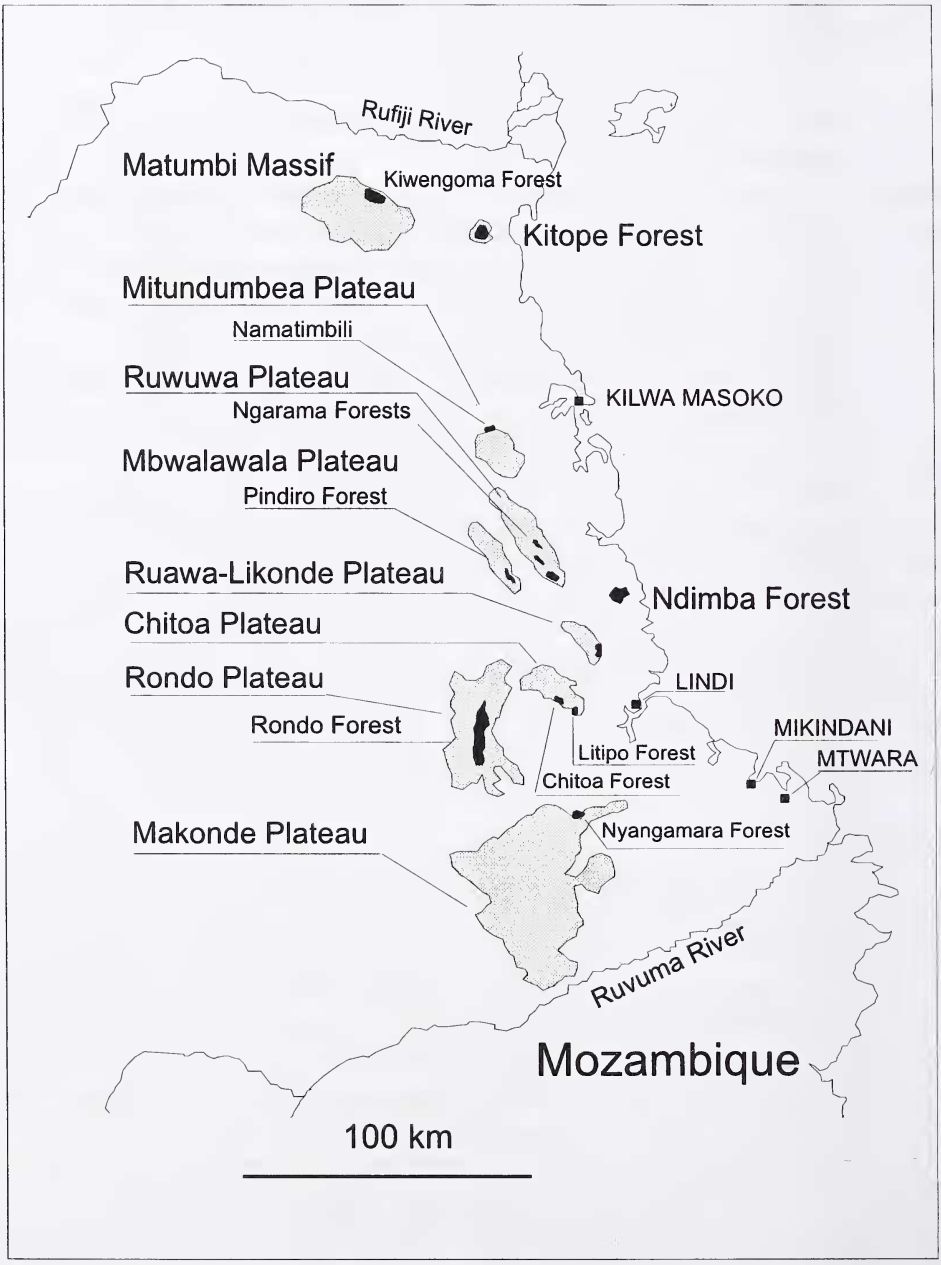

Figure 1. Location of the 11 coastal forests and Mikindani in southeast Tanzania.

briefly in 1967–1968 but most information comes from visits in the late 1980s and early- to mid-1990s (Bagger *et al.* 1990, Burgess *et al.* 1991, Faldborg *et al.* 1991, Holsten *et al.* 1991, Eriksen *et al.* 1994, Baker & Baker 2002). In 2001 we studied the forest bird assemblages of six coastal forests in the Lindi region. Ornithologists visited three of these in the 1990s, but the other three appear not to have been surveyed before.

Methods

Bird surveys were conducted at six coastal forests between October and December 2001 (Kitope, Namatimbili, Ngarama, Ndimba, Ruawa and Chitoa Forests). One, two or three ornithologists worked for three to seven days at each location. A combination of systematic observations and mist-netting was used (except in Ruawa forest where no mist-netting was carried out). Observations were made using the Fjeldså (1999) modification of the Mackinnon list method (Mackinnon & Phillipps 1993). The observer slowly walks (~1–2 km/hour) along natural paths and tracks and writes down all bird species seen or heard. Lists are made within a defined study site of 1.5–2 km^2 in order to ensure that the observations are associated with a particular area. In order to detect elusive ground-dwelling species, between six and 12 six-metre mist-nets were operated in a variety of habitats within the study area.

We also brought together information from all the other forests we were able to trace data for in order to present an overview of the current knowledge of the avifauna in coastal forests of southeast Tanzania. In addition to observations from previous surveys of three of the sites we visited, this included information from five other forests (see Table 1). We have also included records of forest birds collected by Thorkild Andersen in the mid-1960s near Mikindani. Britton (1978, 1980 and 1981) reported on a number of these specimens from forest and "coastal thickets" near Mikindani but we add some previously unreported records based on Andersen skins housed at the Zoological Museum in Copenhagen (ZMUC) and the Naturalis Museum in Leiden (J. Fjeldså, pers. comm.).

We categorise species according to their dependence on forest habitat following Mlingwa *et al.* (2000) where Forest Specialists (FF) are typical of the forest interior and likely to disappear when the forest is modified and Forest Generalists (F) occur in undisturbed forest but are able to exist at the forest edge or in modified and fragmented forests but continue to depend upon forest for some of their resources, such as nesting sites.

A number of forest birds in Tanzania are thought to undertake seasonal altitudinal migration between montane forests of the Eastern Arc Mountains and foothill or coastal forests (see Mlingwa *et al.* 2000). Although still little-understood these movements away from highland forests seem to occur mainly during the cool, dry period. In southern Tanzania this is from June to November (Pratt & Gwynne 1977). The birds then return to the

mountains with the onset of the rain around November to December, which also corresponds to the beginning of the breeding period (Moyer 1993). We use the term 'cold season' to refer to the period from the beginning of June to the end of October.

The taxonomy and nomenclature follow the Ornithological Sub-committee of the EANHS (1996) except for bush-shrikes where we follow Harris & Franklin (2000).

Results

Species richness

A total of 100 bird species have so far been recorded from the 11 studied coastal forests in southeast Tanzania and at Mikindani (see Appendix). Sixty-one of these are forest dependent, with 22 being FF species and 39 F species (Table 2). Rondo and Litipo Forests have the highest number of FF species (21 and 18 respectively). Only Rondo forest has so far been the subject of a good sampling effort (see Table 1) with all but possibly a few cold season migrants likely to have been recorded. Future fieldwork is likely to increase the number of forest dependent species in several of the other forest areas, in particular at Mitundumbea, Ruwuwa and Mbwalawala Plateaus where the sampling effort has been low. A better coverage between June and November may also prove that more forest species migrate to the southeast Tanzanian forests during the cold season.

In some lowland forests north of the Rufiji River even higher numbers of FF species have been recorded. For instance, in the foothill forests of the East Usambaras, 28 FF species occur and in the forest of the Pugu Hills there are 25 FF species (data from Mlingwa *et al.* 2000). The higher numbers of FF species in the Pugu forests compared to the forests south of the Rufiji is partly caused by more montane species reaching this lowland forest during the cold season (e.g. Stripe-cheeked Greenbul *Andropadus milanjensis* and Orange Ground Thrush *Zoothera gurneyi*).

Rare and threatened species

Two globally threatened bird species (East Coast Akalat *Sheppardia gunningi* and Spotted Ground Thrush *Zoothera fischeri*) and two near-threatened species (Southern Banded Snake Eagle *Circaetus fasciolatus* and Plain-backed Sunbird *Anthreptes reichenowi*) occur in the coastal forests of southeast Tanzania (BirdLife International 2004). Only the sunbird is relatively widespread and common in southeast Tanzania and during our fieldwork in 2001 we were able to add two new sites and extend the range of the southeast Tanzanian population north to Namatimbili. The akalat was previously known from only three forest sites in southeast Tanzania but during our fieldwork in 2001 we discovered a small, unknown population at a fourth site, the Ruawa Forest.

Table 1. Summary of fieldwork effort at coastal forests in southeast Tanzania during the late 1980s, the 1990s and in 2001. nmh = no. of nets x metres x hours. Survey effort ranked accounting for forest area, number of visits by ornithologists, length of their visits, number of observers, extent of mist-netting and seasonal coverage. 1 = poor: short visits, little or no mist-netting carried out, several resident forest-dependent species and cold-season visitors likely to be unrecorded. 2 = medium: one thorough or several brief visits, some mist-netting. Most resident forest-dependent species likely recorded, only one or two likely overlooked, several cold-season migrant species likely undetected. 3 = good: much fieldwork in all seasons with extensive mist-netting. All resident forest-dependent species likely recorded, very few cold-season migrants likely overlooked.

Plateau or hill	Forest	Area closed forest	Dates	Field effort	nmh	Sample effort
Matumbi Massif	Kiwengoma Forest Reserve	2200 ha[a]	January–March 1990[b]	17 days x 2 observers	*c.* 25 000	2
Kitope Hill	Kitope Forest Reserve	600 ha[a]	18–23 October 2001[c]	6 days x 3 observers	3100	2
Mitundumbea Plateau	Namatimbili at northern border of Mitundumbea Forest Reserve	300 ha[a]	23–27 November 2001[c]	4 days x 1 observer	2400	1
Ruwuwa Plateau	Ngarama North and South Forest Reserves	1000 ha[a]	4–16 March 1993[d]	13 days x 4 observers	7756	2
			1–3 December 2001[c]	2.5 days x 1 observers	540	
Mbwalawala Plateau	Pindiro Forest Reserve	500 ha[a]	15 March 1993[d]	1 day (observers unknown)	none	2
			11 June–5 July 1993[d]	27 days (observers unknown)	none	
Ndimba Hill	Ndimba Forest Reserve	*c.* 1400 ha*	1996[g]	-	-	2
			1–6 October 2001[c]	6 days x 2–3 observers	2900	
Ruawa–Likonde Plateau	Ruawa Forest Reserve	*c.* 600 ha*	December 2001[c]	4 days x 2 observers	none	2
Chitoa Plateau	Chitoa Forest Reserve	600 ha[a]	26–27 March 1993[d]	1 day x 2 observers	none	2
			6–8 December 2001[c]	4 days x 2 observers	2800	
Chitoa Plateau	Litipo Forest Reserve	400 ha[a]	28 February–7 March 1989[e]	8 days x 4 observers	*c.* 15 400	2
			3–9 July 1990[f]	7 days x 5 observers	*c.* 12 500	
			19–28 March 1993[d]	10 days x 4 observers	6660	
Rondo Plateau	Rondo Forest Reserve	2500 ha[a]	16 October–3 December 1988[g]	3 observers	unknown	3
			15–26 February 1989[e]	12 days x 4 observers	*c.* 26 400	
			11–18 July 1990[f]	8 days x 5 observers	*c.* 17 500	
			16–28 February 1993[d]	13 days x 4 observers	9235	
			29 March–1 April 1993[d]	4 days x 4 observers	2352	
			January– February 1996[g]	-	-	
Makonde Plateau	Nyangamara Forest	600 ha[d]	21–24 July 1990[f]	4 days x 5 observers	*c.* 5000	1

[a]Burgess & Clarke (2000), [b]Burgess *et al.* (1991), [c]this study, [d]Eriksen *et al.* (1994), [e]Bagger *et al.* (1990), [f]Faldborg *et al.* (1991), [g]N. Baker *in litt.*, *our estimate.

Notes on status of selected species

In the following accounts, new information concerning distribution and habitat preferences is presented for selected species. The global threat status mentioned below is the current IUCN Red List Category according to BirdLife International (2004). We also provide new information on distribution and habitat selection of a number of other bird species encountered during field studies in the late 1980s and early 1990s as well as during our fieldwork in 2001.

Southern Banded Snake Eagle *Circaetus fasciolatus*

This globally near-threatened bird of prey (BirdLife International 2004) is a low-density resident in coastal woodlands and forests from south Somalia to South Africa (Snow 1978, Brown *et al.* 1982). Southern Banded Snake Eagles seems to be very locally distributed in southeast Tanzania, recorded only in forests on the Matumbi Massif (Burgess *et al.* 1991), the Mbwalawala Plateau (Eriksen *et al.* 1994), Chitoa Plateau (Litipo Forest, Eriksen *et al.* 1994) and Rondo Plateau (Faldborg *et al.* 1991, Holsten *et al.* 1991, Eriksen *et al.* 1994, this study). From the Rondo Plateau there are also observations from farmland adjacent to Rondo Forest (Faldborg *et al.* 1991) and from woodland west of Rondo Forest in October 2001 (Tøttrup *et al.* 2005). Seddon *et al.* (1999) suggest that this species may breed in lowland forest and winter in submontane forests. Although this may be the case for populations further to the north in Tanzania, observations of Southern Banded Snake Eagles from Rondo Plateau in March, July, October and November (Holsten *et al.* 1991, Faldborg *et al.* 1991, Eriksen *et al.* 1994, this study) do not suggest that this is the case in southeast Tanzania.

Lemon Dove *Aplopelia larvata*

In East Africa this dove is mainly recorded from montane forests up to 3000 m (Britton 1980), but there are also records from the foothills of the Eastern Arc Mountains: one at 450 m in the foothills of the West Usambaras

Table 2. Summary of species richness in each site, by forest-dependence categories. MA = Matumbi Massif—Kiwengoma Forest Reserve; KI = Kitope Hill—Kitope Forest; MT = Mitundumbea Plateau—Namatimbili; RU = Ruwuwa Plateau—Ngarama North and South Forest Reserves; MB = Mbwalawala Plateau—Pindiro Forest; ND = Ndimba Hill—Ndimba Forest; RL = Ruawa-Likonde Plateau—Ruawa Forest Reserve; CH = Chitoa Plateau—Chitoa Forest Reserve; LI = Chitoa Plateau—Litipo Forest Reserve; RO = Rondo Plateau—Rondo Forest; MK = Makonde Plateau—Nyangarama Forest; MI = Mikindani. FF = Forest Specialists, F = Forest Generalists.

	Forests												
	MA	KI	MT	RU	MB	ND	RL	CH	LI	RO	MK	MI	Total
FF	12	10	13	16	13	13	14	16	18	21	5	11	22
F	24	24	25	32	29	23	21	23	31	34	17	16	39
Total	36	34	38	48	42	36	35	39	49	55	22	27	61

on 14 May 1981 and one at 300 m on 19 July 1981 in lowland forest east of the Uluguru Mountains (Stuart & Jensen 1981a). Furthermore, one was mist-netted at 300 m in Magombera Forest in the foothills of the Udzungwa Mountains on 14 September 1984 (Stuart *et al.* 1987). These observations have been taken as a possible indication of seasonal movements to lower altitudes outside the breeding season (Stuart & Jensen 1981b, Stuart *et al.* 1987).

In southeast Tanzania Lemon Dove is only known from Rondo and Litipo Forests where it seems to be rare with only very few observations made. An observation of two birds in Litipo Forest between 28 February and 7 March 1989 (Bagger *et al.* 1990) remains the sole record from this forest. At Rondo, Holsten *et al.* (1991) made a few observations in November 1988 and there is also a single observation from June in the Tanzania Atlas Database (N. Baker in litt.). Since the records are outside the period for cold season movements of montane populations, the Lemon Doves in Litipo and Rondo are thought to belong to small resident populations.

Green Barbet *Stactolaema olivacea*

This barbet, found in both lowland and highland forest, has a local and disjunct distribution. It is found in a few coastal forests in Kenya, Tanzania and Natal while montane populations occur in Tanzania, Malawi and Mozambique (Fry *et al.* 1988).

In southeast Tanzania it was first recorded from Nchingidi on the Rondo Plateau, where a few birds were collected in the 1930s and subsequently assigned to an endemic subspecies *hylophona* by Clancey (1979). Fieldwork between October and December 1988 (Holsten *et al.* 1991), February 1989 (Bagger *et al.* 1990), July 1990 (Faldborg *et al.* 1991) and February to April 1993 (Eriksen *et al.* 1994) strongly suggests that this species has a large resident population in Rondo Forest. Surprisingly, it has never been recorded from Litipo or Chitoa Forests only 20–30 km away. However, in December 2001, we observed Green Barbets in Ruawa Forest *c.* 50 km northeast of Rondo Forest. During our brief visit to Ruawa Forest it was recorded every day and appeared to be common.

Further to the north, Green Barbet has been recorded from Ngarama North and South Forest Reserves on the central and southern parts of the Ruwuwa Plateau in March 1993, where it was found to be uncommon (Eriksen *et al.* 1994). During a brief visit in December 2001 a single bird was recorded during three days of fieldwork. Surprisingly, in November 2001, we found it in high numbers at Namatimbili just north of Mitundumbea Forest Reserve. Here it was common in tall riparian forest and was also recorded from drier forest on the plateau.

It has not been possible to determine the subspecies of the Green Barbets observed at Ruawa, Ngarama or Namatimbili but they are most likely *hylophona* due to their proximity to the original population.

Eastern Green Tinkerbird *Pogoniulus simplex*

This coastal forest near-endemic (*sensu* Mlingwa *et al.* 2000) occurs in coastal forests in Kenya and Tanzania and is also found in foothill forests of some of the Eastern Arc Mountains (Fry *et al.* 1988). Further to the south it occurs in coastal Mozambique and forested hills and small mountains further inland in Mozambique and Malawi (Fry *et al.* 1988).

In southeast Tanzania it is relatively widespread and common in the coastal forests from the central part of the Ruwuwa Plateau and Mbwala-wala Plateau south to Rondo, Litipo and Chitoa Forests (see Appendix). It seems to be more numerous in the southern part of this area.

African Broadbill *Smithornis capensis*

In southeast Tanzania this is a widespread species recorded from all the surveyed forests. We found it to be a surprisingly common species in Kitope, Namatimbili, Ndimba, Ngarama, Ruawa and Chitoa forests, although it is easily overlooked if not for the noisy display flight at dawn. We also found it to be common in denser parts of woodland in southeast Tanzania, sometimes far from coastal forests (Tøttrup *et al.* 2005).

African Pitta *Pitta angolensis*

The East African population of this species has long been known to breed in dense deciduous thickets in southeast Tanzania between December and April, and spend the rest of the year in the forests of southern and western Uganda and in forest patches along the Kenya coast (Britton 1980).

Recent fieldwork has shown that African Pittas also occur in more dense vegetation in southeast Tanzania and, at least occasionally, breed in coastal forests. Thus it appears to be relatively common in dense coastal forest at Ndimba, Rondo, Litipo, Chitoa and Kiwengoma forests during its breeding period (N. Baker in litt., Bagger *et al.* 1990, Holsten *et al.* 1991, Burgess *et al.* 1991, Eriksen *et al.* 1994). The earliest observation was made on 19 November 1988 in Rondo (Holsten *et al.* 1991). Six nests were found in Kiwengoma forest during January to March (Burgess *et al.* 1991) and one nest was located in Rondo Forest on 23 February 1993 (Eriksen *et al.* 1994). We observed African Pittas in Ruawa Forests and at Namatimbili just outside Mitundumbea Forest Reserve in December 2001 but no nests were found. At Namatimbili it was common in closed riparian forest while it occurred in much lower densities in the surrounding dense woodland.

Tiny Greenbul *Phyllastrephus debilis*

The nominate form has two widely-separated populations: in coastal forests in southeast Tanzania and in coastal Mozambique between the Zambezi and Limpopo Rivers some 1200 km to the south (Keith *et al.* 1992). The Mozambique population penetrates inland to eastern Zimbabwe (Keith *et al.* 1992). The subspecies *rabai* is widespread in coastal Kenya from Tana River south to the Rufiji River in Tanzania while a montane subspecies, *albigula*, is found in the Usambaras, Ngurus and Ulugurus (Keith *et al.* 1992).

In southeast Tanzania it is common in most coastal forests south of the Rufiji River (Bagger *et al.* 1990, Holsten *et al.* 1991, Burgess *et al.* 1991, Eriksen *et al.* 1994, this study) with one inland record at Liwale (Britton 1980). Only from the Makonde Plateau at Ngarama Forest and at Mikindani does it seem to be missing. Since there are no records from coastal forests in Mozambique north of Beira the strange 1200 km gap in the distribution of the nominate form is probably real. Outside the breeding season we often observed Tiny Greenbuls in parties with other *Phyllastrephus* greenbuls, in particular Yellow-streaked Greenbul *P. flavostriatus* and Fischer's Greenbul *P. fischeri*.

Fischer's Greenbul *Phyllastrephus fischeri*

A common species in forests and coastal thicket undergrowth from extreme south Somalia, through coastal Kenya and Tanzania, south to northern Mozambique (Keith *et al.* 1992). It is also found in foothill forests of Eastern Arc Mountains from the East Usambaras, Ulugurus (up to 850 m) and the Udzungwas (Keith *et al.* 1992, Svendsen & Hansen 1995). In southeast Tanzania this greenbul is common in most coastal forests (Bagger *et al.* 1990, Holsten *et al.* 1991, Burgess *et al.* 1991, Eriksen *et al.* 1994, this study). Andersen collected 18 specimens in the 1960s near Mikindani, now housed at the ZMUC and the Naturalis Museum, but strangely it has not been recorded from the Makonde Plateau. In October 2001 we recorded it in patches of dense thickets in woodland at Kikole some 50 km inland of Kilwa Kivinje, while it remained unrecorded in woodland on the Rondo Plateau 5–10 km west of the forest reserve (Tøttrup *et al.* 2005).

White-chested Alethe *Alethe fuelleborni*

This is primarily a montane species breeding in the Eastern Arc Mountain forests from the Usambaras south into mountains of northern Malawi and adjacent Zambia (Keith *et al.* 1992). In the 1960s a very isolated breeding population was discovered in a forest near Beira on the coast of Mozambique (Clancey & Lawson 1969, Jensen *et al.* 1985, Jones 1999). In Tanzania it mainly occurs above 1000 m at the onset of the breeding season in November to December (Romdal 2001), but during the cold period many birds descend to groundwater forests in the Eastern Arc foothills (Stuart & Jensen 1981a, 1981b, Stuart *et al.* 1987). Records from Bombo East north of the Usambara Mountains in August (Cordeiro & Githiru 1998) and Pugu Hills (Mlingwa *et al.* 2000) are usually considered to be visitors from montane forests.

On 26 March 1993 two White-chested Alethes were observed at close range in Chitoa Forest (Eriksen *et al.* 1994, Eriksen pers. comm.) outside the time of year for seasonal altitudinal migration to lowland forests. During a short visit in December 2001 when some mist-netting was conducted we found no trace of this species. Thus it remains unclear whether a small resident population occurs in Chitoa Forest or whether the birds observed in March 1993 were casual visitors from montane forests further inland.

East Coast Akalat *Sheppardia gunningi*

This Vulnerable species (BirdLife International 2004) is restricted to a few coastal forests in Kenya and Tanzania (subspecies *sokokensis*, Britton 1980, Waiyaki & Bennun 2000) with an isolated population on the coast of central Mozambique (the nominate form, Keith *et al.* 1992). Furthermore, there are submontane populations (subspecies *bensoni*) in Malawi (Keith *et al.* 1992) and the recently-discovered endemic montane subspecies *alticola* on Nguu Mountain in Tanzania (Seddon *et al.* 1999, Fjeldså *et al.* 2000).

In southeast Tanzania it was only known from three coastal forests: Rondo, Litipo and Chitoa (Holsten *et al.* 1991, Bagger *et al.* 1990). However, in 2001, we discovered a fourth population in Ruawa forest. While it appears to be common in Rondo, Litipo and Chitoa forests, only three observations were made in Ruawa in spite of intensive searching (though without mist-netting).

East Coast Akalat was found to be sensitive to habitat structure and disturbance in coastal forests in Kenya (Nemeth & Bennun 2000), while it was found in a range of habitats from tall, little-disturbed forest to heavily-disturbed evergreen thickets and secondary growth regenerating after logging in the East Usambaras (Evans 1997, Evans *et al.* 1994). Although the habitat preference of this species has not been studied in Tanzania, its restriction to the only four sites with what appears to be the most intact coastal forest in this region suggests a high dependency on primary forest for this population.

Spotted Ground Thrush *Zoothera fischeri*

BirdLife International (2004) categorises this species as Endangered. The nominate form of this elusive thrush is an intra-African migrant moving between breeding grounds in southeast Tanzania and a non-breeding area in coastal Kenya, where it occurs between late March and late November (Bennun 1985). Other populations are known from a few scattered sites in south Sudan, south Zaire, Malawi and South Africa (Collar & Stuart 1985).

The only known breeding area for the nominate form is Rondo Forest where the records are few and the numbers recorded suggest a very small population: six birds with large brood patches were mist-netted in November 1988 (Holsten *et al.* 1991) and four more in late February 1989, also with brood patches (Bagger *et al.* 1990). Two with large brood patches were found on 25 February 1993 and another two on 31 March 1993 (Eriksen *et al.* 1994). In February 1996 three actively-breeding birds were ringed (N. Baker in litt.). A single observation from the nearby Litipo Forest in early March 1989 (Bagger *et al.* 1990) is the only record outside Rondo Forest from southeast Tanzania. A subsequent ten-day visit to Litipo Forest in late March 1993 within the potential breeding period in southeast Tanzania recorded no birds despite considerable searching (Eriksen pers. comm.). Four days of intensive searching, including mist-netting, in Chitoa Forest in December 2001 also proved fruitless (this study), stressing the importance

of Rondo Forest as a breeding area for the nominate Spotted Ground Thrush.

Kretschmer's Longbill ***Macrosphenus kretschmeri***

This species is a Tanzanian near-endemic; a population is also found at Netia on the coast of northern Mozambique (Urban *et al.* 1997) and there are earlier records from Kitovu Forest in Kenya (Zimmerman *et al.* 1996). The nominate form is one of the commonest birds in the lowland forest in the Rubeho Mountains (Fjeldså *et al.* 1997) while it is generally an uncommon resident of forest edge and forest undergrowth at medium altitude in the Usambaras, Ulugurus, Ngurus and Udzungwas (Fjeldså & Rabøl 1995, Urban *et al.* 1997). It is also locally common in forests extending down from Mt. Kilimanjaro (N. Baker in litt.). Small populations in four coastal forests in Tanzania north of the Rufiji also belong to the inland nominate form (Mlingwa *et al.* 2000). The subspecies *griseiceps* was described from Mikindani in 1911 (Mackworth-Praed & Grant 1960) and birds from Netia in Mozambique are also assigned to this subspecies.

Recent records of Kretschmer's Longbill from southeast Tanzania are few. Four specimens housed at the Zoological Museum in Copenhagen were collected in 1965 in coastal thickets near Mikindani. In 1990 a population was discovered in Kiwengoma Forest, where it was "seen once every 2–3 days" during the 2.5 weeks visit (Burgess *et al.* 1991). A single bird was mist-netted in Rondo Forest on the 14 July 1990 (Faldborg *et al.* 1991). Several were subsequently seen in January to February 1996 when two birds also were mist-netted (N. Baker in litt.). In January to February 1996 a few were also observed in Litipo Forest (N. Baker in litt.).

Forest Batis ***Batis mixta reichenowi***

The taxon *reichenowi* is confined to coastal forests in southeast Tanzania from Kitope Hill south to Mikindani. It was treated as an isolated subspecies of the Cape Batis *Batis capensis* by Urban *et al.* (1997) and Harris & Franklin (2000), while Collar *et al.* (1994) and Mlingwa *et al.* (2000) raised it to the rank of a full species. However, until DNA studies shed more light on its systematic position we follow Britton (1980) and the Ornithological Subcommittee (1996) in considering it a subspecies of the Forest Batis *Batis mixta.*

Among the coastal forests south of the Rufiji it was unrecorded only from Kiwengoma Forest on the Matumbi Massif. It is a common bird in Kitope, Rondo, Litipo and Chitoa Forests but less so in the other coastal forests (Bagger *et al.* 1990, Holsten *et al.* 1991, Burgess *et al.* 1991, Eriksen *et al.* 1994, this study). It should be noted that Eriksen *et al* (1994) found it to be uncommon in the forests of the Ruwuwa Plateau in March 1993 while we found it to be relatively common there and recorded it daily in December 2001. During fieldwork on the Rondo Plateau and just north of Mitarura Forest Reserve in 2001 we found East Coast Batis *B. soror* to be common in

the woodland while Forest Batis was never observed in this habitat. Both species also occur on the Mitundumbea and Ruwuwa Plateaus where *B. soror* is common in woodland vegetation and *B. mixta reichenowi* restricted to denser vegetation such as riparian forest (Eriksen *et al.* 1994, this study).

Green-headed Oriole *Oriolus chlorocephalus*

This oriole is a local resident of some coastal forests in Kenya while in Tanzania it is mainly associated with the lower slopes of Eastern Arc Mountains from the Usambaras to the Udzungwas (Fry *et al.* 2000). Other populations occur at higher altitudes in Malawi and northern Mozambique (Fry *et al.* 2000).

Old records of an isolated population in Rondo Forest are mentioned in Mackworth-Praed & Grant (1960) and Snow (1978). Between 1988 and 1993, when extensive fieldwork was carried out on the Rondo Plateau, only a single sighting was made, when an adult was observed on 13 July 1990 (Faldborg *et al.* 1990). However, in January to February 1996 several Green-headed Orioles were seen in Rondo Forest (N. Baker in litt.), suggesting that, although rare, this species still has a small population at Rondo.

Livingstone's Flycatcher *Erythrocercus livingstonei* and Little Yellow Flycatcher *E. holochlorus*

These two flycatchers form a superspecies with Livingstone's Flycatcher occurring south of the Rufiji River and Little Yellow Flycatcher north of the river (Urban *et al.* 1997).

Livingstone's Flycatcher is common and widespread in forests in southeast Tanzania only missing from Kiwengoma and Namatimbili. However, both of these forest areas are relatively little surveyed so it could have been overlooked there. Holsten *et al.* (1990) lists a record of Little Yellow Flycatcher from Rondo (and many Livingstone's Flycatchers from the same area). This remains the only observation of Little Yellow Flycatcher south of the Rufiji and we believe it must have been a misidentified Livingstone's Flycatcher.

Uluguru Violet-backed Sunbird *Anthreptes neglectus*

This sunbird occurs in a few coastal forests in Kenya (where it is rare), in coastal forests in Tanzania and northern Mozambique and in low- and medium-altitude forests of the Eastern Arc Mountains from the Usambaras to the Udzungwas (Fry *et al.* 2000).

In coastal Tanzania south of the Rufiji it has been recorded from most surveyed forests but always at low densities. There are old records from Mikindani (Britton 1980) but no recent observations in coastal forests south of Lindi or on the Makonde Plateau. It has been observed in small numbers in Rondo Forest, Chitoa and Litipo Forests (Bagger *et al.* 1990, Faldborg *et al.* 1991 Holsten *et al.* 1991 and Eriksen *et al.* 1994). We recorded it in Ruawa Forest in 2001 but failed to locate it in the forest on Ndimba Hill. On the Ruwuwa Plateau there are a few records from the central section in

Ngarama North Forest Reserve (Eriksen *et al.* 1994) and we observed it in the northernmost part of the Mitundumbea Plateau at Namatimbili in 2001. It may be more common on the Mbwalawala Plateau where Eriksen *et al.* (1994) recorded it almost daily in Pindiro Forest Reserve. It was also seen a few times in Kiwengoma Forest on Matumbi Massif (Burgess *et al.* 1991) and in the forest on Kitope Hill (this study).

Its general habitat in coastal areas is described as forest and nearby moist woodland, riparian forest and adjacent moist bush (Fry *et al.* 2000) but it has also been recorded in heavily-degraded sub-montane forest and cultivated areas in the Nguu Mountains (Seddon *et al.* 1999). In the Matundu and Mahenge area it has often been recorded in miombo woodland with a certain degree of semi-evergreen vegetation (J. Fjeldså, pers. comm.). Fry *et al.* (2000) furthermore note that Uluguru Violet-backed Sunbird must meet Western Violet-backed Sunbird *A. longuemarei* in the miombo woodland–forest mosaic of coastal Tanzania but that they must be largely mutually exclusive ecologically there. In coastal southeast Tanzania Uluguru Violet-backed Sunbird appears not to occur in woodland habitats but has so far only been recorded from coastal forests, riparian forest and forest edges. In the woodlands on the Rondo Plateau the closely-related Western Violet-backed Sunbird is common (Tøttrup *et al.* 2005) and surprisingly this species was recorded in the open parts of the forest on Ndimba Hill (where Uluguru Violet-backed Sunbird appeared to be missing).

Plain-backed Sunbird *Anthreptes reichenowi*

This globally near-threatened sunbird (BirdLife International 2004) has two widely isolated, but not strongly differentiated, subspecies: the northern *yokanae* in coastal forests in Kenya and Tanzania, and the southern *reichenowi in* central-southern Mozambique, extending to south eastern Zimbabwe and South Africa (Fry *et al.* 2000).

In southeast Tanzania there are records from Namatimbili just north of Mitundumbea Forest south to Mikindani while it is unrecorded from the two northernmost studied forest sites; Kiwengoma and Kitope Forests. It is relatively common where present. In the southern part of its range it also occurs in *Brachystegia* woodland (Clancey 1971) as a possible breeding visitor (Fry *et al.* 2000) and recently it was also discovered in the dense *Brachylaena* woodlands and groundwater forest to the north of the East Usambaras, where it was abundant (Cordeiro & Githiru 1998, 2001). So far it has not been recorded from woodland habitats in southeast Tanzania although it is not confined to the forest interior or undisturbed forest as it has often been recorded from disturbed forest types, riparian forest and forest edges.

Discussion

The coastal forests on the partly-connected Rondo, Chitoa and Likonde–Ruawa Plateaus—in the following collectively referred to as the Lindi

Plateau Forests—stand out as the richest in terms of forest-dependent bird species compared to other forests in southeast Tanzania (Table 2). Collectively, the Lindi Plateau Forests are also the only sites between the Rufiji and Ruvuma Rivers where populations of Lemon Dove, Green-headed Oriole and Black-fronted Bush-shrike *Chlorophoneus nigrifrons* occur. These sedentary species are typically associated with highland forest in East Africa and their colonisation of the Lindi Plateau Forests with a maximum altitude of only 885 m is unexpected and suggests that past climatic conditions were significantly different.

Pleistocene climatic fluctuations are believed to have influenced many parts of Africa (Hamilton 1981) and are also believed to have affected the eco-climatic conditions in southeast Tanzania (Clarke 2000b). Periods of aridity are usually associated with the most recent glaciation and this has probably reduced and fragmented a formerly more contiguous forest cover along the Tanzania coast. The high species richness of the Lindi Plateau Forests and the occurrence of isolated relict populations of forests species suggest that these forests may have functioned as a refugium for lowland forest-dependent birds during such periods. The Lindi and Makonde Plateaus are the highest areas in southeast Tanzania but the Lindi Plateau probably receives the highest rainfall when the trade winds from the northeast bring moist air from the Indian Ocean. This is because the escarpments on the Lindi Plateau attract significant orographic precipitation while most of the highest ground of the Makonde plateau is in the rain-shadow of Lindi Plateau. As it is generally assumed that the trade winds did not change direction significantly during the last glaciation (Prell *et al.* 1980), a forest cover large enough to support forest-dependent birds seems most likely to have survived a dryer climate on the Lindi Plateau.

In addition to being a refugium for forest birds in southeast Tanzania during Pleistocene glaciations, the isolation of forest birds in the Lindi Plateau forests may also have led to differentiation. Two subspecies are endemic to the coastal forests between the Ruvuma and Rufiji Rivers: the subspecies *reichenowi* of the Forest Batis and the subspecies *hylophona* of Green Barbet. The subspecies *griseiceps* of Kretschmer's Longbill is a near-endemic limited to coastal forests in Tanzania south of the Rufiji and a single site on the coast of northern Mozambique (Baker & Baker 2002). Furthermore the Lindi Plateau Forests are the only known breeding area of the nominate form of Spotted Ground Thrush (Baker & Baker 2002). Assuming that during glaciations forest in southeast Tanzania was mainly limited to the Lindi Plateau it seems likely that the population divergence in these taxa occurred *in situ*. Its significance as a local centre of endemism is further emphasised by the recent discoveries of an undescribed species of endemic galago, three endemic forest reptiles and at least two endemic butterflies (Burgess 2000). The Lindi Plateau has also been identified as a local centre of endemism for vascular plants since the level of floristic

endemism in these forests is strikingly higher than in neighbouring areas, in spite of an apparent similarity in topography and vegetation (Clarke 2001).

Despite uneven knowledge of the forests dealt with in this paper, with some forests being more adequately surveyed than others (Table 1), we show that the richness of the forest avifauna and the occurrence of small populations of several species of conservation concern emphasise the importance of the Lindi Plateau Forests. All forests on the Lindi Plateau known to be important to birds are Forest Reserves and were recently designated as Important Birds Areas (Baker & Baker 2002). In spite of this, an increased conservation initiative in this area is urgently needed because in reality the forests are poorly protected from illegal cutting, charcoal exploitation and subsistence farming. The completion of the Mkapa bridge across the Rufiji River in 2003 is seen by many as a catalyst for accelerated development in the regions south of the river. However, major concerns have been raised that the establishment of reliable means of transport will lead to escalating illegal timber harvesting and forest degradation south of the Rufiji (Milledge 2004).

To enhance overall conservation activities in this area, we recommend that Mitundumbea Forest Reserve, Ngarama North and South Forest Reserves and Pindiro Forest Reserve receive additional ornithological investigations. Further studies of these little-known areas will provide important information to help preserve some of the last-remaining viable stands of coastal forest in southeast Tanzania.

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Appendix

Bird species recorded from 11 coastal forests south of the Rufiji River and around Mikindani, southeast Tanzania. See text for definition of forest dependency codes F and FF. Taxonomy and nomenclature follow Ornithological Sub-committee of the EANHS (1996) except for bush-shrikes where we follow Harris & Franklin (2000).

Forest sites and source of information on avifauna: MA = Matumbi Massif—Kiwengoma Forest Reserve: Burgess *et al.* 1991. KI = Kitope Hill—Kitope Forest: this study. MT = Mitundumbea Plateau—Namatimbili: this study. RU = Ruwuwa Plateau—Ngarama North and South Forest Reserves: Eriksen *et al.* 1994, this study. MB = Mbwalawala Plateau—Pindiro Forest: Eriksen *et al.* 1994. ND = Ndimba Hill—Ndimba Forest: N. Baker in litt., this study. RL = Ruawa-Likonde Plateau—Ruawa Forest Reserve: this study. CH = Chitoa Plateau—Chito Forest Reserve: Eriksen *et al.* 1994, this study. LI = Chitoa Plateau—Litipo Forest Reserve: Bagger *et al.*1990, Faldborg *et al.* 1991, Eriksen *et al.* 1994. RO = Rondo Plateau—Rondo Forest: Bagger *et al.* 1990, Faldborg *et al.* 1991, Holsten *et al.* 1991, Eriksen *et al.* 1994, Baker & Baker 2002, N. Baker in litt. MK = Makonde Plateau—Nyangarama Forest: Faldborg *et al.* 1991. MI = Mikindani: Britton 1978, Britton 1980, Britton 1981, specimens at the Zoological Museum in Copenhagen and the Naturalis Museum in Leiden.

		MA	KI	MT	RU	MB	ND	RL	CH	LI	RO	MK	MI
F	Southern Banded Snake Eagle *Circaetus fasciolatus*	X				X				X	X		
F	African Goshawk *Accipiter tachiro*	X	X	X	X	X	X	X	X	X	X	X	
F	Ayres's Hawk Eagle *Hieraaetus dubius*			X						X			
FF	Crowned Eagle *Stephanoaetus coronatus*	X	X	X	X	X			X		X	X	
	African Cuckoo Falcon *Aviceda cuculoides*					X		X			X		X
F	Bat Hawk *Macheiramphus alcinus*							X					
F	Crested Guineafowl *Guttera pucherani*	X		X	X	X				X	X	X	
FF	Lemon Dove *Aplopelia larvata*									X	X		
F	Tambourine Dove *Turtur tympanistria*	X	X	X	X	X	X	X	X	X	X		
	Emerald-spotted Wood Dove *Turtur chalcospilos*		X		X	X	X	X	X	X	X	X	
F	African Green Pigeon *Treron calva*				X	X					X		
	Brown-necked Parrot *Poicephalus robustus*		X	X	X	X	X	X	X	X	X	X	
F	Brown-headed Parrot *Poicephalus cryptoxanthus*	X			X	X	X		X	X	X		
F	Livingstone's Turaco *Tauraco livingstonii*	X	X	X	X		X	X	X	X	X		
	Violet-crested Turaco *Musophaga porphyreolopha*				X	X							
FF	Barred Long-tailed Cuckoo *Cercococcyx montanus*	X		X	X	X	X	X	X	X	X		X
	Didric Cuckoo *Chrysococcyx caprius*				X		X					X	
F	Emerald Cuckoo *Chrysococcyx cupreus*			X	X		X	X	X		X		X
	Klaas's Cuckoo *Chrysococcyx klaas*		X	X	X	X	X	X					X
	Asian Lesser Cuckoo *Cuculus poliocephalus*			X	X			X					
F	Yellowbill *Ceuthmochares aereus*		X	X	X	X	X			X	X		
	Spotted Eagle Owl *Bubo africanus*				X					X	X		
F	African Wood Owl *Strix woodfordii*	X	X	X	X	X	X	X	X	X	X	X	
F	Fiery-necked Nightjar *Caprimulgus pectoralis*				X	X					X	X	
F	Böhm's Spinetail *Neafrapus boehmi*			X	X	X				X	X	X	
F	Mottled-throated Spinetail *Telacanthura ussheri*			X	X	X	X	X		X	X		X
F	Narina's Trogon *Apaloderma narina*	X	X	X	X	X	X	X	X	X	X	X	X
	Brown-hooded Kingfisher *Halcyon albiventris*		X	X	X	X				X	X	X	
	Mangrove Kingfisher *Halcyon senegaloides*			X				X	X				X
	African Pygmy Kingfisher *Ispidina picta*	X	X	X	X			X	X	X	X		X

		MA	KI	MT	RU	MB	ND	RL	CH	LI	RO	MK	MI
	Broad-billed Roller *Eurystomus glaucurus*				X		X			X	X		X
	Green Wood-hoopoe *Phoeniculus purpureus*		X	X	X	X	X		X	X	X		
F	Trumpeter Hornbill *Ceratogymna bucinator*	X	X	X	X	X	X	X	X	X	X	X	X
	Crowned Hornbill *Tockus alboterminatus*		X	X	X	X	X	X	X	X	X	X	
F	White-eared Barbet *Stactolaema leucotis*	X	X										
FF	Green Barbet *Stactolaema olivacea*			X	X			X			X		
F	Yellow-rumped Tinkerbird *Pogoniulus bilineatus*	X	X	X	X	X	X	X	X	X	X		X
FF	Eastern Green Tinkerbird *Pogoniulus simplex*				X	X	X	X	X	X	X		
	Lesser Honeyguide *Indicator minor*				X	X	X		X		X		
	Pallid Honeyguide *Indicator meliphilus*		X										
	Scaly-throated Honeyguide *Indicator variegatus*			X					X		X		
F	Golden-tailed Woodpecker *Campethera albingoni*	X	X		X	X	X		X	X	X	X	X
	Little Spotted Woodpecker *Campethera cailliautii*	X			X	X	X		X	X	X	X	X
	Cardinal Woodpecker *Dendropicos fuscescens*		X	X	X	X			X	X	X	X	X
	Bearded Woodpecker *Dendropicos namaquus*									X			
FF	African Broadbill *Smithornis capensis*	X	X	X	X	X	X	X	X	X	X	X	X
FF	African Pitta *Pitta angolensis*	X		X	X		X	X	X	X	X		X
	Black Rough-wing Swallow *Psalidoprocne pristoptera*	X		X	X	X			X	X	X		X
	Black Cuckoo-shrike *Campephaga flava*		X		X	X	X		X	X	X	X	X
	Zanzibar Sombre Greenbul *Andropadus importunus*		X		X			X				X	
F	Little Greenbul *Andropadus virens*									X	X		
F	Yellow-bellied Greenbul *Chlorocichla flaviventris*	X	X	X	X	X	X		X	X	X	X	
F	Eastern Nicator *Nicator gularis*	X	X	X	X	X	X	X	X	X	X	X	
FF	Tiny Greenbul *Phyllastrephus debilis*	X	X	X	X	X	X	X	X	X	X		
FF	Fischer's Greenbul *Phyllastrephus fischeri*	X	X	X	X	X	X	X	X	X	X		X
FF	Yellow-streaked Greenbul *Phyllastrephus flavostriatus*	X	X	X	X	X	X	X	X	X	X		X
F	Terrestrial Brownbul *Phyllastrephus terrestris*		X		X			X		X			
FF	White-chested Alethe Alethe fuelleborni								X				
	Eastern Bearded Scrub Robin *Cercotrichas quadrivirgata*	X	X		X	X	X		X	X	X	X	
	White-browed Robin Chat *Cossypha heuglini*				X								X
F	Red-capped Robin Chat *Cossypha natalensis*	X	X	X	X	X	X	X	X	X	X		X
FF	Red-tailed Ant Thrush *Neocossyphus rufus*	X	X	X	X	X	X	X	X	X	X		X
FF	East Coast Akalat *Sheppardia gunningi*							X	X	X	X		
FF	Spotted Ground Thrush *Zoothera fischeri*									X	X		
	Kurrichane Thrush *Turdus libonyanus*				X	X							X
F	Ashy Flycatcher *Muscicapa caerulescens*		X		X				X	X			X
	Yellow-breasted Apalis *Apalis flavida*		X	X	X	X	X	X	X	X	X	X	
FF	Black-headed Apalis *Apalis melanocephala*				X					X	X		
	Grey-backed Camaroptera *Camaroptera brachyura*	X	X	X	X	X	X	X	X	X	X	X	
	Tawny-flanked Prinia *Prinia subflava*		X		X					X	X	X	
FF	Kretschmer's Longbill *Macrosphenus kretschmeri*	X								X	X		X
F	Yellow White-eye *Zosterops senegalensis*			X		X					X		
	Black-and-White Flycatcher *Bias musicus*	X	X		X	X			X	X	X		X
F	Black-throated Wattle-eye *Platysteira peltata*		X	X	X	X				X	X	X	X
	Livingstone's Flycatcher *Erythrocercus livingstonei*		X		X	X	X	X	X	X	X	X	X
	African Paradise Flycatcher *Terpsiphone viridis*					X				X	X		
FF	Blue-mantled Crested Flycatcher *Trochocercus cyanomelas*	X	X	X	X	X	X	X	X	X	X	X	X
F	East Coast Batis *Batis soror*				X	X			X		X		
FF	Forest Batis *Batis mixta*		X	X	X	X	X	X	X	X	X	X	X
	Retz's Helmet-shrike *Prionops retzii*		X		X		X				X	X	
F	Chestnut-fronted Helmet-shrike *Prionops scopifrons*	X	X	X	X	X	X			X	X		X
F	Black-backed Puffback *Dryoscopus cubla*	X	X	X	X	X	X	X	X	X	X	X	
	Tropical Boubou *Laniarius ferrugineus*	X	X	X	X	X	X		X	X	X	X	

		MA	KI	MT	RU	MB	ND	RL	CH	LI	RO	MK	MI
F	Four-coloured Bush-shrike *Chlorophoneus viridis*	X	X		X	X	X	X	X	X	X	X	X
FF	Black-fronted Bush-shrike *Chlorophoneus nigrifrons*		X								X		
F	Square-tailed Drongo *Dicrurus ludwigii*	X	X	X	X	X	X	X	X	X	X	X	X
	African Golden Oriole *Oriolus auratus*				X	X				X	X		X
	Black-headed Oriole *Oriolus larvatus*					X					X		X
F	Green-headed Oriole *Oriolus chlorocephalus*										X		
	Violet-backed Starling *Cinnyricinclus leucogaster*				X		X				X		X
F	Black-breasted Glossy Starling *Lamprotornis corruscus*	X		X	X		X	X	X	X	X		X
F	Collared Sunbird *Anthreptes collaris*	X	X	X	X	X	X	X	X	X	X	X	
F	Uluguru Violet-backed Sunbird *Anthreptes neglectus*	X	X	X	X	X		X	X	X	X		X
	Western Violet-backed Sunbird *Anthreptes longuemarei*						X						
FF	Plain-backed Sunbird *Anthreptes reichenowi*			X	X	X	X	X	X	X	X	X	X
FF	Olive Sunbird *Nectarinia olivacea*	X	X	X	X	X	X	X	X	X	X		X
	Mouse-coloured Sunbird *Nectarinia veroxii*		X		X		X			X			X
F	Dark-backed Weaver *Ploceus bicolor*	X	X	X	X	X	X	X	X	X	X	X	X
F	Peter's Twinspot *Hypargos niveoguttatus*	X	X		X	X	X	X	X	X	X	X	X
FF	Green-backed Twinspot *Mandingoa nitidula*	X			X	X	X		X	X	X		